**INTRODUCTION**

Augmented Reality (AR) is a technology which allows computer-generated virtual imagery to overlay physical objects exactly in real time. Unlike virtual reality (VR), where the user is completely immersed in a virtual environment, AR allows the user to interact with the virtual images using real objects in a seamless way. Azuma [1] provides a commonly accepted definition of AR as a technology which (1) combines real and virtual imagery, (2) is interactive in real time, and (3) registers the virtual imagery with the real world. As such there are many possible domains that could benefit from the use of AR technology such as engineering, entertainment and education.

While it may be some time before AR technology becomes mature, there are many issues, both technical and social, that should be pursued in the meantime. One of the important aspects is creating appropriate interaction techniques for AR applications that allow end users to interact with virtual content in an intuitive way. It was not until the mid-nineties that the first collaborative AR applications were developed. The Studiersube [78] and Shared Space projects [9] showed that AR could support remote and co-located activities in ways that would otherwise be impossible [72].

For co-located collaboration, AR can be used to enhance a shared physical workspace and create an interface for 3D CSCW [8]. In testing with the Shared Space application, users found the interface very intuitive and conducive to real world collaboration, because unlike other interfaces, the groupware support can be kept simple and mostly left to social protocols [8].

In the rest of the paper, I first present several research topics presented at these conferences. Next, I provide a comprehensive review of the number of AR papers published in each of these topic areas. Then, in Sections 5, 6 and 7 respectively, I focus specifically on the important topics of AR tracking, interaction and display technology, discussing research developments, the main problems explored in the field and current and future AR research directions. We come to conclude in Section 8.

**METHOD**

The main method used in this research is to review previously published conference papers and other related material from the conference proceedings of ISMAR’02 to ISMAR’07 and its forerunner events, IWAR’98, IWAR’99, ISMR ’99, ISMR ’01, ISAR’00 and ISAR ’01. There are 276 full and short papers contained in these proceedings, providing an interesting snapshot of emerging research trends in Collaborative AR over the last ten years. I exclude posters which are typically shorter and not normally reviewed as rigorously.

The following three questions spcifically guided the analysis of the collected research. (1) Which areas have been explored in AR? (2) What are the developments and key problems in these areas? Moreover, (3) what are important future trends for AR research?

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